

**PALEO-ACADEMY 2006:**

**CLIMATE CHANGE:**

**THE 50-million-year GEOLOGIC RECORD**

**at JOHN DAY FOSSIL BEDS NATIONAL MONUMENT.**

Offered collaboratively by  
North Central Education Service District, Oregon PaleoLands Institute,  
Western Oregon University, and OMSI  
[www.paleolands.org](http://www.paleolands.org)

*PaleoAcademy is a workshop for K-12 educators that connects new discoveries and cutting-edge science with PNW landscapes. By helping educators connect new findings about geology, tectonics, climate change, natural resources, and human history with their local landscapes, we believe that student and teachers alike will find learning more exciting and relevant. In 2006, our focus is Climate Change, and how regional landscapes inform us about past climates.*

**PaleoAcademy 2006 Objectives:**

- 1) Understand the history of past climates, especially those of Oregon and the PNW during in the past 50 million years.
- 2) Understand the geologic evidence for past climates found in the John Day Basin.
- 3) Identify and understand the processes involved in formation of the following common Oregon rocks: basalt, andesite, rhyolite, ignimbrite, lahar, tuff, shale, mudstone, sandstone, conglomerate.
- 4) Know the general geologic history of Oregon, and the specific geologic history of the John Day basin, including the names of geologic time periods.
- 5) Practice and hone field observation skills.
- 6) Employ these concepts in cross-curricula lessons in writing and math for their classrooms, and demonstrate examples of these lessons.
- 7) Develop and teach at least one comprehensive lesson or unit involving climate change and its scientific evidence in their curricula and in their classroom.



**Overview and expectations:**

Paleo Academy 2006 will explore and examine the geology and landscapes of the John Day Basin, and especially the John Day Fossil Beds National Monument, in the context of its outstanding evidence for climate change from the Eocene through Holocene. Teachers will examine the geologic record, and understand how the geologic record informs us about past climates—and future climate change and its likely consequences.

One objective of this workshop is to develop a “learning community” To facilitate this, we ask that participants stay together in the same accommodations throughout the workshop, sharing meals, tribulations, and fellowship throughout the project. This event is truly a retreat, and we hope that by providing a quiet environment of thoughtful educators we can spur creative thought and new approaches to teaching. Participants in the workshop will be expected to share breakfast, lunch and dinner together, as well as evenings around either a campfire or riverbank.

A portion of the workshop will include time in the field with JDFOB paleontologists, and a short field project to examine part of the climatic record here.

Teachers will work in teams to construct a geologic/climatologic history of the John Day Basin area as part of their final workshop project. They will keep a field notebook that records their observations and thoughts. A critical part of the course is developing lessons and lesson plans during the workshop, and present preliminary versions to the group on the final day of the workshop.

Those who are taking this workshop for credit will be asked to provide detailed lesson plans for 1) one comprehensive lesson plan or unit involving climate change and its scientific evidence, especially involving their local landscape, and 2) detailed lesson plans that incorporate localized geologic or climate information in a cross-curricula (writing, math, history, etc.) lesson.



**READING:** Required and recommended reading is listed at the end of the course schedule.

**COLLEGE CREDIT:** Credit is available through Western Oregon University Division of Extended Programs. PaleoAcademy can be offered as a "Credit Overlay" course, at \$45.00/unit graduate or undergraduate. Students must REGISTER by or on the 1st day of class.

**Graduate**

GS 508M Paleontology Teacher's Institute, 2 Units: this is the weeklong course

GS 506M " " 1 Unit, Curriculum Design Workshop, independent project following course

**Undergraduate**

GS 408 Paleontology Teacher's Institute, 2 Units: this is the weeklong course

GS 406 " " 1 Unit, Curriculum Design Workshop, independent project following course.



**Accommodations, Costs. And Scholarships:**

This year PaleoAcademy will be centered at Service Creek Stage Stop, Spray, Oregon, an historic and beautifully restored bed and breakfast inn near the John Day River. Cost for the workshop is \$345, which includes room and meals at Service Creek. Cost without room is \$ 200. Participants MUST share breakfasts and dinner with the group. Limit: 12 workshop participants.

*(Note: We have room for three couples in rooms with queen or king beds. We invite "significant others", but ask that, unless they are participating teachers, they pay the full rate (\$345) to help support the program. )*

**Financial Aid:** Thanks to a generous grant from the North Central Education Service District (NCESD), full to partial support for costs of workshop tuition, room and board is available to teachers from Oregon.

**FOR ADDITIONAL INFORMATION ABOUT PALEOACADEMY,**

**To apply for Financial Aid, or to register, contact:**

Ellen Bishop at Oregon PaleoLands Institute for an application form.

Phone: 541-763-4480 or [ebishop@oregonpaleoproject.org](mailto:ebishop@oregonpaleoproject.org).

## **COURSE SCHEDULE**

The schedule below is subject to minor changes based upon weather and needs/specific interests of the class.

**Monday, July 31:**

### **Introduction to Climate Change and the Geologic Record, Eocene climates and ecosystems**

*Reading: Papers 1,2,3,4,5,6, 9.*

8:00 am Introductions at Service Creek Lodge: Place-based teaching—making science and scenery relevant. Ellen Bishop.

8:30 am Rock types, and what they can tell us about past environments: Jeff, Ellen

9:30 am Understanding Geologic Time:

- The Geologic Time Scale: How did we learn about geologic time? What are the major time periods, and what, basically happened then? Ellen and/or Jeff.
- How to help students relate to geologic time and the time scale: Sarah
- How do we tell geologic time? Jeff Myers and Ellen Bishop
  - A. Using Stratigraphy and field relations:
    - Laws of superposition
    - Original horizontality
    - Cross cutting relationships
    - Conformities, non conformities
  - B: Radiometric and other dating techniques:
    - Radiometric Dating: U/Pb; K/Ar; Ar-Ar, C14, Be10, and others. Ellen Bishop
    - Dendrochronology: Ellen and Jeff Myers



11:00 Find Time: Collect fossil, consider its environment and age at WHS Fossil bed.

- Think about the environment here; reconstruct the—local ecosystem, physical setting, and climate.
- What might have lived here?
- How were these leaves preserved?
- Put it in the context of geologic time.

12:00 pm-2:00PM ( OPLI office/family Service Bldg.) Connecting local paleontology, past climate, and geologic history.

- Is the earth's climate stable? Why/how do climates change? What is the past history of global climate change?
- What climates/ time periods are represented in the John Day Fossil Beds What other extremes of climate change are represented in the geologic/fossil record? What is the PETM? Permian Extinction?
- Evidence for and consequences of climate change demonstrated in the fossil record?
- General stratigraphy and geologic history of this area: Eocene to Present.
- 2:30-5:00 PM: Quantitative paleoclimate interpretations from fossil leaf morphology. Leaf architecture: understanding leaf form, function, and connection to the climate. Dr. Jeff Myers.

5:30 pm Dinner at Camp Hancock. Possible interaction with campers on some form of geology.

- 6:30-8:00: Explore the Clarno paleontologic history, including Hancock Tree and Forest Floor. Begin work on field-based project: a geologic column and history of this landscape.

## **Tuesday:**

### **The Oligocene:**

#### **A time of temperate climates and changing ecosystems.**

*Reading: 7, 8, 16, 17*

7:00 AM Drive to JDFB,

8:30 AM: Walk thru Blue Basin with Sarah Herve.

10:00 AM: Thomas Condon Paleontology Center tour with Sarah.

11:00AM:

- Group A: Horse Evolution/climate change with John Fiedor
- Group B: Plant Leaf Margins and Climate Change with Jeff Myers

1:00 pm Lunch

1:30 pm Groups Switch

- Group A: Plant Leaf Margins and Climate Change with Jeff Myers
- Group B: Horse Evolution/climate change with John Fiedor

4:00 pm Wrap Up, Evaluation, Reflection at Condon Center.

5:00: PM Return to Service Creek. Dinner, digestion, discussion.

## **Wednesday August 2:**

### **THE PAINTED HILLS:**

#### **Soils and fossils as a record of climate and climate change.**

*Reading: 10, 11, 12*

7:00 AM Review. Teams present strat. columns of Eocene and Oligocene deposits, discuss what they learned on Monday and Tuesday's trips during breakfast.

8:00 AM: Depart for Painted Hills via Twickenham.

9:00 AM Paleosols: What do they tell us?

1:00 pm Visit backcountry sites in John Day Gulch or other private land recommended by Regan, Greg Retallack. Excavate, compare soils from Late Eocene climate and Oligocene climate. Ellen Bishop

3:30 pm Return to Service Creek. Discussion.

5:30 pm Dinner at Service Creek;



## **Thursday August 3:**

### **Miocene to the Present:**

#### **The Columbia River Basalts, Caldera Eruptions near Burns, and the Rattlesnake Fm.**

*Reading: 13, 14*

7:00 AM Discussions of the Oligocene's temperate climate and evidence found on Wednesday. The Miocene-present: Cooling continues in a basalt-covered PNW.



9:15 am Travel to Columbia River basalts of Picture Gorge, and the Mascall Formation, Rattlesnake, and stratigraphy and climates of Sheep Rock and the John Day Valley. Glaciation on Canyon Mountain; Ice Age floods in eastern Oregon Ellen Bishop

12:00 Lunch

1:00: Shady, riverside spot, OR Use air-conditioned classroom space at JDFOB for lesson-planning session—or return to Service Creek. Teachers in teams 1) Produce a geologic column and their own geologic and climate history of the region, 2) use this as a springboard to develop ideas for lessons, integrating climate change and geology into multidisciplinary classroom work, which may include writing, art, or math.

4:00 pm Teams share histories, lesson-plan ideas.

5:30 pm Dinner, followed by Movie: Day After Tomorrow. (Climate change, Hollywood style!)

**Friday, August 4<sup>th</sup>**  
**Putting the puzzle together,**

*Reading: 6*

8:00 am Breakfast at Service Creek. Teachers form teams to develop lessons, and also develop something called the “Climate Game” for use in their classes, based upon what they have learned. Faculty (Bishop) available to help, spur discussions, help with planning.

11:00 Check out of Service Creek house, officially. Teachers break into teams. Teams develop lesson about climate change, time and/or local geology, develop game kids can play using time, climate change, local geology.

1:00: Teams present lessons/games. Group provides more ideas, suggestions to each team.

3:00 End of workshop (Beginning of project for those who wish additional, one-credit of independent study)



## CREDIT REQUIREMENTS:

Credit options for this class are as follow:

College Credit: Credit is available through Western Oregon University Division of Extended Programs. PaleoAcademy can be offered as a "Credit Overlay" course, at \$45.00/unit graduate or undergraduate. Students who wish credit **MUST REGISTER** by or on the 1st day of class. Students must pay for credit themselves, although support is also available through scholarships..

### **Graduate**

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GS 406 " " 1 Unit, Curriculum Design Workshop, independent project following course.



To receive credit for the workshop (GS 508 or GS 408) participants must hand in the following within one week of the end of the workshop (Much of this will be completed during the class) :

- 1) Field notebook kept during the class.
- 2) Sketched, annotated geologic column of the John Day Fossil Beds area,
- 3) Brief geologic and climate history based upon their own field work and observations.
- 4) One page synopsis of why and how climate has changed here in the past 60 million years.
- 5) One lesson plan that they will use that focuses on climate change.
- 6) One lesson plan or concept for how to incorporate climate change into curricula outside science.

To receive credit for 1 unit of independent study, participants will work with Dr. Jeff Myers or Dr. Ellen Bishop to develop a comprehensive unit that is focused on and/or creatively utilizes evidence that is local to their classroom to help students understand and envision past or on-going climate change.

## PALEO ACADEMY 2006 READING LIST:

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**Required:** This reading is required, and will greatly assist your understanding and appreciation of day-to-day field work. Please read or review the required reading prior to the workshop. All are (relatively) short, readable, understandable references. Please contact us for assistance with access to these publications.

- 1) Bice, Karen L., and Jochem Marotzke, 2002. Could changing ocean circulations have destabilized methane hydrate at the Paleocene-Eocene boundary? *Paleoceanography*, v. 17, p1-9.
- 2) Bowen, Gabriel J., David Beerling, Paul Koch, James Zachos, and Thomas Quattlebaum, 2004. A humid climate state during the Paleocene-Eocene thermal maximum. *Nature*, v.
- 3) Bralower, Timothy J., Isabella Premoli Silva, and Mitchell J. Malone, 2002: New evidence for abrupt climate change in the Cretaceous and Paleogene: An Ocean Drilling Program expedition to Shatsky Rise, northwest Pacific. *GSA Today*: Vol. 12, No. 11, pp. 4–10.
- 4) Katz, Miriam E., Benjamin S. Cramer, Gregory S. Mountain, Samuel Katz, and Kenneth G. Miller, 2001. Uncorking the bottle: What triggered the Paleocene/Eocene thermal maximum methane release? *PALEOCEANOGRAPHY*, VOL. 16, pp 549–562.
- 5) Kerr, Richard, 2006. Opening the door to a chilly new climate regime. *Science*, v. 312, p. 350.
- 6) Leslie, Clare Walker, John Tallmadge, and Tom Wessels, 1999. *Into The Field: A guide to locally-focused teaching*. Orion Press, 81 pp.
- 7) McIntosh, William C., 1997. Age of the plant-bearing tuffs of the John Day Formation at Fossil, Oregon, based upon  $^{40}\text{Ar}/^{39}\text{Ar}$  single-crystal dating, In: *Oregon Geology*, February 1997, Vol. 59, Issue 1, pp.3-5, 20
- 8) Myers, Jeffrey, 1996. Volcanic arcs and vegetation, In: *Washington Geology*, June 1996, Vol. 24, Issue 2, pp.37-39
- 9) Palmer, Alison. The geologic Time Scale, 1999. [www.geosociety.org/science/timescale/timescl.pdf](http://www.geosociety.org/science/timescale/timescl.pdf)
- 10) Retallack, Gregory J., Erick Bestland, and Theodore J. Fremd, 2000. Eocene and Oligocene Paleosols of Central Oregon. *GSA Special Paper 344*. Esp pp. 2-22 and 122-140.
- 11) Retallack, G., 1991 *Field Guide to Tertiary Paleosols*. Oregon Geology 1991.
- 12) Scher, HOWIE, and Ellen Martin, 2006. Timing and Climatic Consequences of the Opening of the Drake Passage. *Science*, vol. 312, pp. 428-430.
- 13) Streck, Martin and Mark Ferns, 2004. The Rattlesnake Tuff and Miocene silicic volcanism in eastern Oregon USGS OFR 2004-1222
- 14) Tolan, Terry, L., Stephen Reidel, Marvin Beeson, James Lee Anderson, Karl Fecht, and Donald Swanson, 1989. Revisions to the estimates of areal extent and volume of the Columbia River Basalt Group. IN: Riedel, Stephen and Hooper, Peter R., *Volcanism and Tectonism in the Columbia River Flood-basalt province*. Geological Society of America Special Paper 239. Pp.1-20.
- 15) Wing, Scott L., 1994. Fossils and fossil climate; the case for equable continental interiors in the Eocene, 1994, pp.35-44
- 16) Wolfe, Jack A., 1999. Fossil leaf character states; multivariate analyses, 1999, pp.233-239
- 17) Wolfe, Jack A., 1994. Tertiary climatic changes at middle latitudes of western North America, In: *Palaeogeography, Palaeoclimatology, Palaeoecology*, April 1994, Vol. 108, Issue 3-4, pp.195-205.

**Recommended for the workshop:** These books will enrich your understanding of Oregon's geology, and overall geologic principals, global history and the mechanisms for climate shifts. Familiarize yourself with some or all of them prior to the workshop for the best results! (\* marks those most directly connected with the workshop) You may order these from Amazon.com through the OPLI website ([www.paleolands.org](http://www.paleolands.org)) at significantly reduced prices—and help support this program through your purchase.

- \*Bishop, E. M., 2006. *In Search of Ancient Oregon*. Timber Press, \$29.95, pb.
- Erwin, Douglas, 2006. *Extinction*. Princeton Univ Press, 296 pp. \$24.95
- Flannery, Tim, 2006. *The Weather Makers: How man is changing the climate, and what it means for life on Earth*. Atlantic Monthly Press. 384 pp., \$24.00
- \*Louv, Richard, 2006. *Last Child in the Woods*. Algonquin Books, 335 p.
- \*Maslin, Mark, 2005. *Global Warming. A very short introduction*. Oxford Univ. Press, 184p. \$9.95
- \*Prothero, Donald, 1994. *The Eocene-Oligocene Transition: Paradise Lost*. Columbia Univ Press. \$12.95
- Thomson, Keith, 2005. *Fossils. A very short introduction*. Oxford University Press, 160 p. \$9.95
- Winchester, Simon, 2002. *The Map that Changed the World*. Perennial, pb \$13.95